

Low-Pass Filters and the 144MHz Band

So, you think that there's no need to use a low-pass filter when using v.h.f.? Nigel Booth M1DKN suggest otherwise ... and provides a suitable design.

here's much misunderstanding regarding filters and suppression at v.h.f. Many texts suggest one method, whereas others may lead you on a totally different path. I shall try to clear up this misleading information as well as explaining why filtering is such a necessity practice on all bands (d.c. to blue light). You may well think "Oh no, not another righteous person about to tell us that we have been doing it wrong for years"! Well no, I'm just providing a few ideas and guidelines to get you on the right path ... especially for those newer operators who, perhaps, haven't yet got that all important filtering sorted to the best of their ability.

Firstly, why do we need extra filtering? Well, the answer quite simply is because all radio transmitters produce what are known as harmonics. You know, those are the things we learnt about whilst studying for the Radio Amateur Examination (RAE).

The second harmonic of I44MHz falls into a portion of the radio spectrum that's primarily used by military aircraft (the RAF). However, the third harmonic falls right back within our own Amateur bands (this is also true of signals supposedly in the 430MHz band).

Best Ability

It is good practice however, to be careful and to our best ability, to filter out any unwanted harmonics that may be generated. As I said previously, this is where a conflict of ideas comes into being!

There is one camp opting for the high-Q band-pass filter at the output of the amplifier stages or linear amplifier and those who opt for the low-pass filter and/or possibly the harmonic notch filter. So, you have a choice of opinions!

The correct method of filtering ("oh no, here he goes again" I can imagine you saying!) is by means of a low-pass filter and/or a harmonic notch filter. The reasons behind this are as follows: The practice of putting a high-Q bandpass filter at the output of an amplifier can be extremely damaging to both your equipment and to your on-air reputation.

The smallest amount of mis-tuning or mis-match at the antenna, which can very easily be done, can result in a very high s.w.r. Unless, your coaxial cable is both lossy and long, then this high s.w.r. at the antenna is transferred back down to the rig.

There are other risks too! Trying to use maximum power, with a sustained s.w.r. of greater than 3:1 can damage or even totally destroy some solid state output devices, many of which don't take too kindly to this sort of treatment.

Running with a high v.s.w.r. and a 'cooking' p.a. stage, can also can cause high intermodulation products or over-deviation throughout the band. It could possibly even affect other bands ... adjacent to the one you're using.

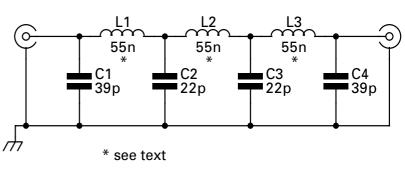
Nearby Stations

Nearby Amateur Radio stations may not take too kindly to the extraneous 'rubbish' and may be even less tolerant than your equipment. After all, you should know better ... shouldn't you?

Fortunately, the problem of unwanted signals is easily overcome, especially with the simplicity of the

WS2219

 Fig. 1: A seven-element low-pass filter follows the 'traditional' form. For high power cladded silver mica capacitors should be used - see text for more details.



low-pass filter from the constructors point of view. At least those intermodulation products above the wanted band, are reduced to a low level after your signal is passed through a low-pass filter.

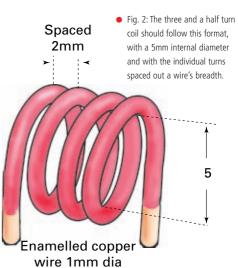
The seven pole filter described in this article should offer second harmonic rejection of around 30dB and third harmonic rejection of

60dB+. It also demonstrates a very low insertion loss. The components used should be satisfactory for power levels up to 100W, as the capacitors are of the metal-cased mica type.

The circuit is of a relatively simple symmetrical low-pass filter. It combines three identical inductors of 55nH each, and four capacitors of two values as shown in the circuit diagram of **Fig. 1**.

Causes Problems

Creating the correct value inductors sometimes causes, problems, but winding the coils for this low-pass filter is quite easy. Each coil consists of three and a half turns, Fig. 2, of I mm diameter enamelled copper wire, with the turns spaced one wire diameter apart.



The turns are wound on a 5mm diameter former, which is removed after winding. And to get repeatable coils, I suggest that you try winding two coils at once. Both coils being wound interleaved with two wires laid side by side at the same time. Then after the turns are 'set' by pulling the wires tight, you should separate the two windings and you have two (almost) identical coils. Repeat this procedure and you have one spare coil too!

Should you be going only to use low power (up to about 20W) then simple mica capacitors would be suitable for the filter. But for higher power levels you really should use the jacketed mica type.

Well that's it, quite simple really. Good constructing, and hopefully you'll have clean signals from here on!